. ELECTRIC CO.
tation & Control
Florence Ave.
d, Calif. 90301

INSTRUCTION MANUAL

MODEL 301

AC MICROAMMETER

FOR SERIAL # _____

Quan-Tech®

Div. of Scientific-Atlanta, Inc.

Specialists in Electronic Instrumentation

Electronic Services - Los Angeles
M14363X

Randolph Park West, Randolph Township, New Jersey 07801
Telephone: (201) 361-3100 TWX 710-987-7946

INSTRUCTION MANUAL

GENERAL ELECTRIC CO.
Instrumentation & Control
228 W. Florence Ave.
Inglewood, Calif. 90301

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MODEL 301 MICROAMMETER

GENERAL

The Quan-Tech Model 301 Microammeter is designed for Current measurement of transistor circuits, magnetic amplifiers, small servo systems, and other similar networks. Its low input impedance and extreme sensitivity make low level current measurement possible without affecting the circuit under test.

Two input probes are provided:

1. A clamp-on probe, which enables quick measurements to be made of currents within the range of 300 microamperes to 100 milliamperes without disconnecting leads in the circuit under test.

2. An insertion probe, which provides for greatest accuracy of measurement over wide current and frequency ranges and with greatest sensitivity (3 microampere full scale meter reading).

SPECIFICATIONS

Sensitivity
With insertion probe, 3 ua to 100 ma full scale.
With clamp-on probe, 300 ua to 100 ma full scale.

Accuracy
With insertion probe, $\pm$2% of full scale at 1 KC.
With clamp-on probe, $\pm$5% of full scale at 1 KC.

Frequency
With insertion probe, flat within $\pm$2%, 50 cycles to 100 KC, -3 db at 10 cycles and 1 MC.
With clamp-on probe, $\pm$5%, 100 cycles to 100 KC, -3 db at 50 cycles and 1 MC.

Input Impedance
2 ohms plus 8 uh, 60 mmf to ground on ranges 3 ua through 1 ma. Negligible impedance and capacitance on ranges 300 ua and 100 ma.

Oscilloscope Connection
0.1 volt into 10 K ohms.

CONTROLS AND INDICATORS The controls and indicators comprise:

1. A power input cord with integral plug which is permanently attached to the instrument at the back.

2. The power switch which is provided with a pilot indicator.

3. The meter range switch which is directly below the meter.

4. The connector for attaching either one of the two probes.

5. An output jack for the connection of oscilloscope or other external instrument.

OPERATION To use Quan-Tech Model 301 Microammeter, proceed as follows:

1. With power switch at OFF, plug power cord into 115-volt, 60-cycle supply.

2. Turn meter multiplier control to 1000.

3. Turn power switch to ON.

NOTE. Although this instrument is completely transistorized, a daily warm-up period of a few minutes is required. If the instrument has not been used for several days, the warm-up period should be extended to 15 minutes. This enables the electrlytic capacitors to reduce their noise by reforming.

4. Select one of the two probes and connect it to the front panel. As a guide for the selection and use of the probes see "Operational Notes" below.

5. Connect the probe to the circuit under test.

6. If meter indication is very small, turn meter multiplier switch to lower value until meter indication comes to mid-scale or above.

OPERATIONAL NOTES

For quickest and easiest measurements, within the range of 300 ua to 100 ma, use the clamp-on probe. This probe is carefully constructed of high permeable magnetic material and the mating surfaces are lapped to insure minimum leakage. This probe forms a transformer having a turns ratio of 1 to 100 when clamped around a wire.

> CAUTION. Although this probe is built as ruggedly as its nature permits, it should be handled with care to avoid damage to or distortion of the mating surfaces. A thin film of light lubricating oil should be applied to the lapped surface from time to time.

For greater sensitivity and accuracy, use the insertion probe. This probe is a current transformer enclosed in a mu metal shield to eliminate stray magnetic pick-up. It has two turn ratios; 1 to 1 and 1 to 100. The 1 to 1 ratio permits measurements down to 3 ua full scale with a noise level less than 0.1 ua.

Care should be taken to avoid excessive currents applied to the probes. When the instrument is adjusted in the range of 300 ua to 100 ma not more than 500 ma DC should be applied. With the insertion probe and in the 3 ua to 1 ma range the DC current should not exceed 10 ma. Larger currents will result in a decrease in the low frequency response and possible distortion. Extremely large currents may destroy the windings in the insertion probe.

Since there is some feed-thru capacity in the probe, it should be used on the low side of high impedance circuits at high frequencies.

Note that each probe is marked with a polarizing dot indicating the positive terminal to give a positive voltage at the output monitor.

This instrument is of the averaging type, calibrated in rms volts for pure sine wave. Allowances must be made for other waveforms.

It should be noted that there is no capacity coupling within this instrument. Consequently, if the input terminals are employed for anything other than the probes furnished with the instrument, DC should not be applied.

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MAINTENANCE AND REPAIR

The instrument may be removed from the case by removing two screws on the side and four screws in the back panel. DO NOT REMOVE SCREWS FROM THE FRONT PANEL unless the instrument is out of its case and then only if it would facilitate repair.

The components in this instrument are standard commercial units. Replacement parts can be obtained from Quan-Tech Laboratories, but they also are probably available at your supplier.

In replacing components on the printed circuit board, the iron should be hot enough to make a good solder connection and applied for as short a period as possible. Pressure that might push the copper away from the board while hot should not be applied.

RECALIBRATION If recalibration is needed, proceed as follows:

1. Allow a warm-up period of at least 15 minutes so that the noise level is reduced to a minimum.

2. Using an oscillator tuned to 1 KC, apply 3 ua to the times 1 position of the insertion probe being careful to avoid pick up of stray fields due to large loops.

3. Adjust R7 to give -18 volts from the regulated supply.

4. Adjust R42 until meter reads 3ua on the 3 range.

5. Set current source to 10 ua and adjust R26 for full scale on the 10 range.

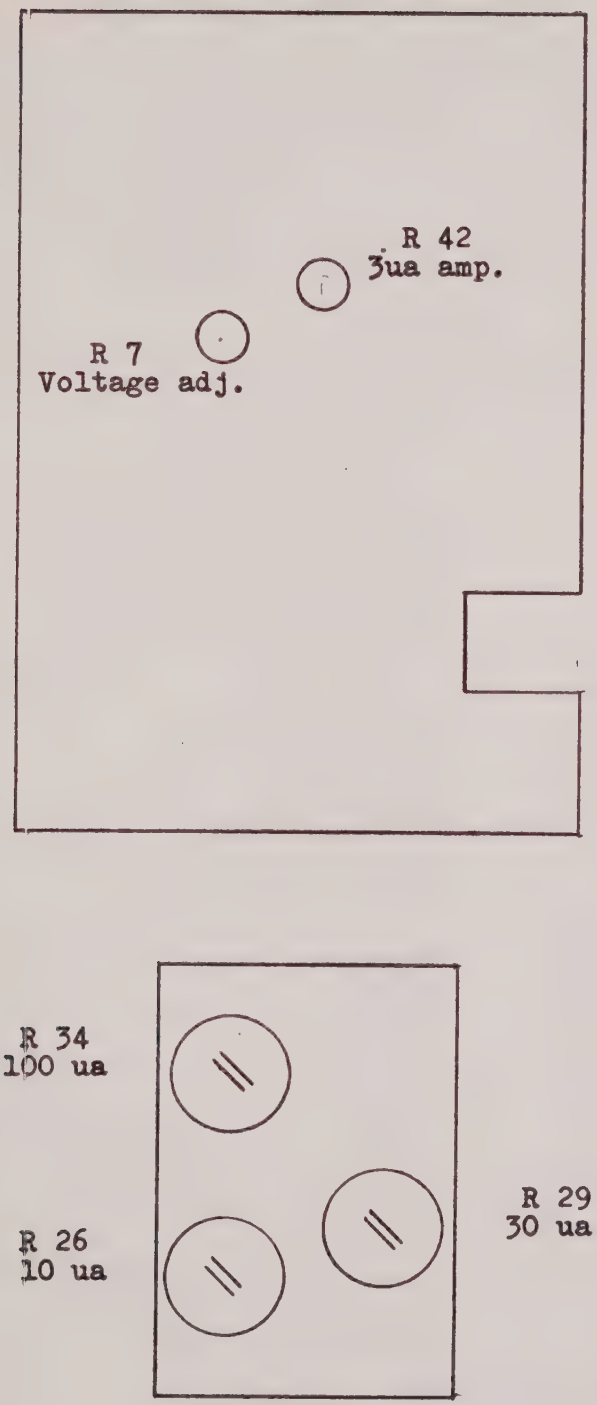
6. Set generator to 30 ua and adjust R29 for full scale on the 30 range.

7. Set generator to 100 ua and adjust R34 for full scale on the 100 range.

8. Check ranges 300 and 1000 for alignment. If these positions show more than 1% error, connect an oscilloscope to the monitor output to detect possible stray pickup due to interference. Then repeat the above procedure.

THEORY

Quan-Tech Model 301 Microammeter consists of six transistor stages having a large amount of negative feedback around each amplifier pair. A grounded base input and a feedback factor of nearly unity from the second stage gives an input impedance of approximately 1 ohm and unity current gain. The amplifier pair comprising Q5 and Q6 is a gain stage. The final pair contains the metering circuit. Linearity is achieved by current feedback through the meter and diodes. An output monitor is provided from the feedback resistor in the final stage. A series resistance of 1K ohms and a blocking condenser protect the circuit from severe l loading by the monitor. Additional stability and freedom from line transients is obtained from the regulated power supply.



Calibration adjustments

SEMICONDUCTOR LEGEND

Changes and improvements in the semiconductor products available for commercial use necessitate type changes from time to time. To eliminate confusion and costly paperwork, many of these changes will be covered in the following legend. The purpose of this legend is to acknowledge the fact that the type number on a semiconductor found in a piece of equipment will not necessarily correspond with the type number given on the schematic diagram.

The legend is not intended to be an interchangeability list although in many cases good quality components* within a given category may be substituted with acceptable results. Normally, replacements should be made using components having the same type number as the component being replaced.

Those components bearing an asterisk on the schematic diagram are factory selected components and should be obtained from Quan-Tech.

*It should be noted that the incoming inspection procedure followed at Quan-Tech includes noise screening on most semiconductors.

TYPE NO. ON SCHEMATIC	TYPE NO. IN EQUIPMENT
1N482A	1N648, 1N3604, 1N3605
1N703	1N748, 1N749
1N709	1N753
1N2859	1N3253, 1N3254
1N2862	1N3254
1N3253	75A4, 1N3254
1N3254	75A4
1N3604	1N3605, 1N4151, 1N482A, 1N648
1N3605	1N3604, 1N4151, 1N482A, 1N648
MPD400	MPD401, 1N5179
TIS73	TIS74, TIS75, 2N4392
TIS74	TIS75, 2N4392
TIS75	TIS74, 2N4392
TI480	2N1613, 2N3566, 2N3643 A322, 2N929
TI494	2N1613, 2N3566, 2N3643, A322, 2N929
UC240	2N4869, 2N3819
2N270	2N3644, 2N3250, 2N3251
2N396A	2N414, 4JX1G759, 4JX1D653, 2N1305, 2N3644, 2N3250, 2N3251
2N414	2N396A, 4JX1G759, 4JX1D653, 2N1305, 2N3644, 2N3250, 2N3251

TYPE NO. ON SCHEMATIC	TYPE NO. IN EQUIPMENT
2N929	A322, A324, A642, 220N2, 2N930, 2N3566, 2N3643, 2N2219
2N1304	2N929, 2N930, 2N1306, 2N3566, 2N3643, A322
2N1306	2N929, 2N930, 2N1304, 2N3566, 2N3643, A322
2N1515	2N3644, 2N3250, 2N3251
2N1613	2N929, 2N930, 2N3566, 2N3643, A322, 2N2219
2N2219	D16C33, 220N2, A322, A324, A642, 2N929, 2N930, 2N3566, 2N3643
2N2603	2N3250, 2N3251, 2N3644
2N3250	2N3251, 2N3644
2N3251	2N3250, 2N3644
2N3566	2N3643, A322, 2N929, 2N2219
2N3643	2N3566, 2N2219, A322, 2N929
2N3644	2N3250, 2N3251, 2N3762
2N3762	2N3250, 2N3251, 2N3644
2N3819	TIS73, TIS74, TIS75, TIS58, TIS59, 2N4869, UC240
2N4392	TIS74, TIS75, 2N3819
2N4869	2N3819, UC240

SCHEMATIC LEGEND

k – 1000

– Screw Driver Adjustment

– Front Panel Control

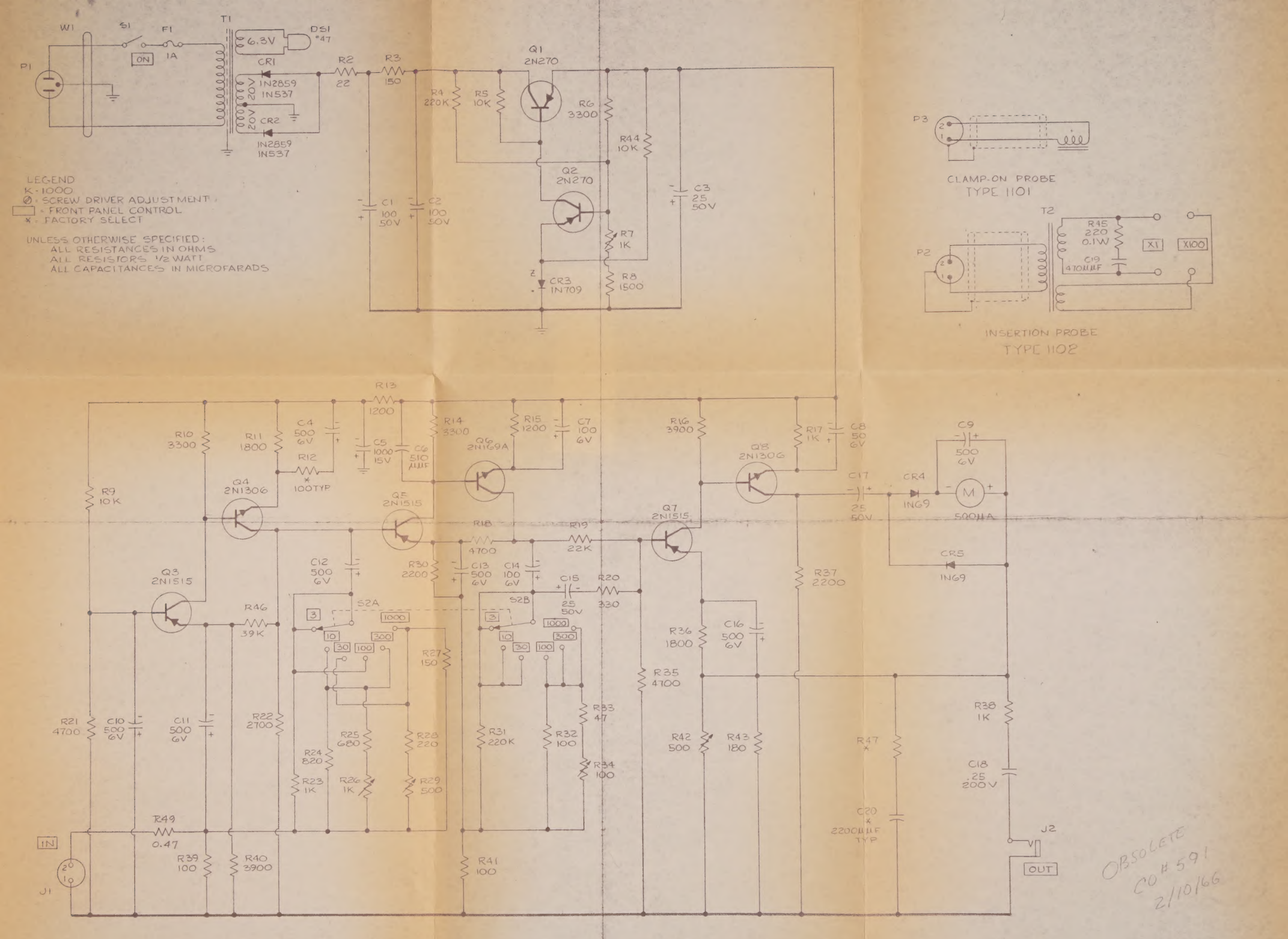
* – Factory Select

Unless Otherwise Specified:

All Resistances in Ohms

All Capacitances in Microfarads

5/15/75



OBSOLETE
CO # 591
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SCHEMATIC
A.C. MICROAMMETER
MODEL 301

C-1059-U